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PROFITABLE AND FRUITLESS LINES OF ENDEAVOR IN PUBLIC HEALTH WORK[1]

IT is in accord with the spirit of this Congress to consider public health questions either from the point of view of things already accomplished by the application of the scientific method or from that of things to be done. I have chosen to speak especially of "the saving of waste and increase of efficiency" still to be expected when public health problems are approached in a scientific spirit.

It is well recognized to-day by many experts that while some of the ordinary activities of municipal health departments are of unquestionable value in conserving the health of a community, others are relatively ineffective or possibly worthless. One well-known writer[2] has thus expressed himself on this point:

> I boldly assert that if every case of communicable disease were promptly reported to the proper local board of health and as promptly placed under effective sanitary control and so kept until danger of infection had passed, all the other present-day activities of boards of health, whether local, state or national, with the exception of those directed against certain causes of infant mortality, and the possible further exception of some food and drug inspection, might be dropped with no appreciable effect upon the general health or mortality of any of our states or most of our cities.

In all fairness it must be admitted that a part of the energy of almost every municipal health department in this country

[1] Paper presented before the Congress of Technology, Boston, April 10, 1911, to commemorate the fiftieth anniversary of the granting of the charter to the Massachusetts Institute of Technology.

[2] M. N. Baker, chairman Committee on Municipal Health and Sanitation, National Municipal League.

is devoted to combating imaginary dangers or applied to tasks that have only a remote bearing on the public health.

This condition, as a rule, is not due to ignorance on the part of health officials, but to the pressure of public opinion. Such pressure is often exerted directly through legal ordinances passed by uninformed legislative bodies, but sometimes also through agitation by mistaken enthusiasts or through other channels of public opinion. Back of the whole situation is the existence in the public mind of wrong or antiquated conceptions of disease and the causes of disease. It was unfortunate in many respects for the cause of public health that much of the popular interest in health matters was evoked before the germ theory of disease and its corollaries became fully developed. As the result of premature generalization the public has warmly espoused a number of wrong conceptions of disease and of ways of preventing disease. To be specific, two instances of this confusion are found in the demand for garbage disposal and plumbing inspection.

Sanitarians do not admit that even a grossly improper method of garbage disposal can have much to do with the spread of disease in a sewered city or that diphtheria or typhoid fever or any other disease is properly attributable to the entrance of sewer air into dwelling houses. So firmly embedded in public belief, however, is the connection of piles of decaying garbage with outbreaks of infectious disease, and of "defective plumbing" with all sorts of maladies that to the average citizen "garbage disposal" and "plumbing inspection" bulk large as the chief if not the only activities of a municipal health department.

In the light of our present knowledge we may well ask what are the actual dangers to health from these two sources? It is now well known to bacteriologists that disease germs do not "breed" in garbage heaps, but that on the contrary if added from outside they speedily die off. The offensive odors of decomposition may be unpleasant and undesirable; there is no evidence that they produce disease or dispose to disease. On the other hand, it may be argued that the existence of heaps of decomposing organic matter tends to maintain or create general habits of uncleanliness which themselves are detrimental in a roundabout way to the health of a community. And again it is known that the house-fly may breed in garbage piles, particularly if horse manure is present, and that under certain conditions this noxious insect may become the bearer of disease germs to food. But when the worst is said it must be admitted that the known danger to health from garbage piles and "dumps" is relatively insignificant compared with the danger from other well-known but less popularly feared sources. Disease does not originate in garbage piles, however offensive they may be; the house-fly, however disgusting and annoying its habits, suffers from no disease transmissible to man, and does not convey disease unless it has access to material in which disease germs are present. The truth is that garbage disposal in large cities is more a matter of municipal housekeeping than of public health; proper methods of garbage collection and destruction must be urged rather from economic and esthetic considerations than on hygienic grounds. There are of course certain features in the handling of refuse and waste that need hygienic control, just as there are in street cleaning, but the problem is essentially not one of public health. At present in some cities the department of health is burdened with the task of caring for the city waste and its success or failure as a conservator of the

public health is too often measured by the frequency with which coal ashes are scattered in alleys or the length of time that decaying vegetable matter remains in tin cans in hot weather. In some cases the larger part of the annual health department appropriation must be expended for garbage collection and disposal, leaving only a pitifully small residue for other needs. To mention a single instance, the collection and conservation of garbage and ashes cost the Minneapolis Health Department in 1909 about $57,000, leaving approximately $43,000 for all the other activities of a health department serving a city of over 300,000 inhabitants.

One thing should be clearly understood by municipal authorities and by the general public, that regular collection and cleanly handling of ashes and table scraps is not one of the surest and most profitable ways of protecting health and preventing disease. Efficient administration of this branch of public work should not be allowed to take the place of measures that directly affect the public health.[3]

Few dangers to health have loomed larger in the public eye than that from "sewer gas." Elaborate and amazingly expensive systems of plumbing are required by law to be installed in every newly erected dwelling house in our large American cities. Plumbing inspection today occupies a large part of the working force of many municipal health departments. In Baltimore in 1908, to cite a single instance, this work was carried out by one inspector of plumbing, seven assistant inspectors of plumbing and one drain inspector at a total salary cost of $8,250 or about one tenth of the total salary appropriation for all public health work. And yet, if all the most recent and searching investigations such as those of Winslow and others are to be believed, the actual peril to health involved in the entrance of small quantities of sewer air into houses is so small as to be practically negligible. It may be questioned whether plumbing inspection, as ordinarily conducted, can be shown to save a single life or prevent a single case of disease. There is certainly no reason to suppose that any infectious disease is due to germs carried in sewer air. It might reasonably be maintained that slightly leaky gas fixtures are a much more serious menace to the health of house dwellers than defective plumbing. At all events our present knowledge affords small justification for the expenditure of public money to insure that the odor of peppermint does not enter our houses when oil of peppermint is designedly introduced into the house drains. It may be worth while for the house builder to satisfy himself of the character of the plumbing as of the character of the mortar, but compulsory inspection by public officials is hardly warranted on the ground of a high degree of demonstrated danger to the public health. It is certain, too, that the enforced installation of immensely complicated and elaborate piping and trapping systems simply adds to the cost of building without any compensating hygienic advantages. The plumbing ordinances of our large cities often contain inconsistencies and contradictions, what is required in one city being sometimes forbidden in another. A revision and simplification of municipal plumbing regulations, a minimizing of official inspection and especially an educa-

[3] Any one who fancies that to depreciate garbage disposal as a health measure is flogging a dead horse will be disabused of this impression if he has experience with the beginnings of a typhoid epidemic and learns how often public attention is diverted from significant issues like water-supply, milk-supply, and contact, by appeals to the prejudice against slovenly ways of handling harmless household refuse.

tion of the public to the fact that diphtheria, typhoid fever and scarlet fever have never been definitely traced to sewer air or bad plumbing are reform measures that might release a considerable sum of public money for use in really profitable lines of sanitary endeavor.

In the matter of heating and ventilation enormous sums have been spent and are being spent to "renew" the air in rooms and public assembly halls and to introduce "pure air" in what has been assumed to be necessary amounts. And yet if the work of Beu,[4] Heymann, Paul, Erclentz, Flügge,[5] Leonard Hill and others means anything it demonstrates that the whole effect from "bad air" and crowded rooms is due to heat and moisture and not to carbon dioxid or to any poisonous excretions in expired air. When all the effects of "crowd poison" upon a group of individuals in an experimentally sealed chamber can be eliminated by rapidly whirling electric fans it is useless any longer to look upon carbon dioxid as "a measure of danger." If we recognize that all the discomfort from breathing air in a confined space is due to a disturbance of the thermal relations of the body, the problem of ventilation becomes very different from what has usually been supposed. In temperate climates at all events it ought to be much simpler to provide for proper heat regulation of the body than to warm a large volume of outside air and introduce it into a building continuously or at stated intervals. It may well be asked whether the elaborate legal regulations governing the "supply" of air and the cubic feet of bedroom space have a real basis in scientific knowledge. If over-heating, moisture-content and stagnation of the air are the chief things to be avoided, may this end not be reached more effectively and less expensively than by present methods?

One conspicuous function at present required of or voluntarily exercised by health departments is the practise of terminal disinfection after cases of infectious disease. This has come to play a large part in municipal health activities and is responsible for an important share of the expense. In Boston, for example, in 1909, about one tenth of the annual appropriation was expended for disinfection. One of the most experienced New England city health officers has recently seriously questioned the value of such an expenditure.[6] After a study of the ratios of recurrences in certain diseases he concludes that, "Both theory and facts, so far as any data are available, indicate that terminal disinfection after diphtheria and scarlet fever is of no appreciable value." This view has met with strong support from the experience of a number of English health officials, even if it can not be regarded as conclusively proved. Every one now knows that the large sums of money spent in measures of disinfection directed against yellow fever gave little return in added safety. We can hardly take for granted that any process of combating disease is effectual simply because it is customary or traditional. It is evident that the whole question of disinfection needs to be studied afresh with a view to actual efficacy. It is not a subject for laboratory experimentation alone, but must be investigated as a problem of practical public health administration.

Other instances of the application of energy and money to measures apparently of slight or doubtful value might be cited, but those already given are fairly typical. The question that should be asked in every

[4] *Zeitschr. f. Hyg.*, 1893, 14, p. 64.

[5] *Zeitschr. f. Hyg.*, 1905, 49, p. 363.

[6] Chapin, *Jour. Amer. Public Health Assoc.*, 1911, 1, p. 32.

case is not whether a particular measure is entirely devoid of value, but whether it is the most effective way of utilizing available resources. As matters now stand there are a number of unquestionably valuable measures that can not be prosecuted with sufficient vigor because of the enforced diversion of funds into other and less profitable channels.

Efficacious measures may sometimes be distinguished from the fruitless or relatively unprofitable by their direct and unmistakable outcome in the saving of life and the prevention of disease. A few illustrations may be noted.

The importance of control and supervision of the sources of public water supply has long been recognized, but the importance of controlling the quality of the public milk supply, although frequently urged by sanitarians, is not always appreciated. At the present time in the great majority of American cities it is safe to say that for every case of infectious disease due to drinking water ten cases are caused by infected milk. It is difficult to secure adequate funds for the sanitary control of the milk supply. By sanitary control of milk is meant not the upholding of a rigorous standard of butter fat and total solids, but the maintenance of proper standards of cleanliness and health for dairy cows and especially the safeguarding the milk from infection during collection and transportation. Under some conditions the protection of the consumer against milk-borne infection may be best brought about by compulsory pasteurization of that portion of the milk supply which can not otherwise be raised to proper standard. Whatever method of control be adopted, it is certain that any genuine improvement in the character of a milk supply will be followed in the long run by a lessening in the amount of typhoid fever, diphtheria, scarlet fever and to some extent tuberculosis. The early detection of a single case of typhoid fever or scarlet fever on a dairy farm may be the means not only of preventing an extensive epidemic, but of avoiding the formation of scores of new foci which can in turn serve to light up subsequent cases for many years. Proper pasteurization of milk has been followed in many cities, as in Glasgow, Liverpool and London, by an immediate and material reduction in the amount of typhoid fever. In other words, the connection between an expenditure of public money and a direct return in prevention of disease can be more clearly demonstrated in the case of milk-supply control than in some other of the usual municipal health department activities.

The question whether the quality of a city milk supply can be more favorably influenced by inspection and supervision at the source, or by generally enforced and controlled pasteurization is one upon which there is still some difference of opinion among experts. There is little doubt, however, that simply as a matter of economy of administration much is to be said at present in favor of centralized pasteurization of a large portion of the supply. Viewed as a method for preventing a large number of cases of infectious disease at relatively small expenditure the pasteurization of milk certainly ranks high among effective health measures.

One of the important bacteriological advances of the last few years has been the discovery that a considerable number of healthy persons, convalescents or others, harbor disease germs and that these persons are important agents in spreading disease. The detection and proper treatment of disease-germ carriers, particularly in the more serious diseases and before or in the early stages of an epidemic, is now recognized as an important although difficult

task. The whole question of the control of germ-carriers is one that needs more careful study with a view to determining the actual results of the methods adopted. From this point of view, inspection of school children, especially at the beginning of the school year, is probably to be classed as a highly profitable activity, although it is to be wished that fuller and better-studied statistics were available.

Inspection of school children is highly valuable, also, in detecting various common congenital or acquired defects. If the defects are remediable, their early discovery may avoid development into permanently crippling disorders. In other cases, the application of simple corrective or palliative measures may greatly increase the industrial efficiency of the individual. If the defects are not remediable, their detection will at all events prevent the choice of unsuitable occupations, and will indicate desirable lines of education.

In rural communities, undoubtedly one of the simplest, as well as most important, health protective measures is the adoption, under compulsion if need be, of a safeguarded and standardized form of barrel privy.[7] A corollary hardly necessary to mention is the total abolition of the privy in all thickly settled towns. For lack of such regulations soil pollution occurs, the house-fly finds an opportunity to transfer disease germs from excreta to food, and typhoid fever and hookworm disease become constant plagues over wide regions.

In the campaign against tuberculosis it is perhaps too early to evaluate the numerous methods that have been proposed for lessening or eradicating this disease, but it is already evident that some are more directly repaying than others in proportion to the effort involved. Among the methods for which public funds are legitimately available none is more promising than the provision of sanatoria for advanced cases of consumption. Newsholme and Koch have shown that the general diminution in the death rate from tuberculosis observed in most countries can be more reasonably attributed to the establishment of sanatoria than to any other factor, and that in addition to its humanitarian advantages, the segregation and proper control of the advanced and dangerously infective cases is one of the most useful methods that can be employed by the community to protect itself against the spread of tuberculous infection.

Another field in which practical workers are convinced that certain measures have direct efficacy in saving life is that of infant mortality. It has even been said that for the expenditure of a certain sum the saving of a life can be guaranteed. Certain it is, that in few public health activities is the ratio between effort expended and results obtained so clearly seen. No one doubts to-day that prompt notification of births, education of the mother through any one of a number of agencies, and special provision for suitable feeding of infants during hot weather are factors that are bound to tell powerfully in the reduction of infant mortality. It may confidently be asserted that the degree of success achieved in this field will be limited only by the amount of endeavor the community is willing to put forth.

It is impossible at present to apply direct tests of efficiency to some measures that undoubtedly promote health. The influence of playgrounds, public baths, regulation of the hours of labor in extra-arduous industries and the like is real if it can not be accurately determined or estimated.

[7] See Public Health Reports for 1910, published by the Public Health and Marine Hospital Service, articles by Stiles and Gardner, and Lumsden, Roberts and Stiles.

Certain activities of a health department may be worth continuing for their educational value, although their direct utility may be questioned. Many topics need investigation in order to discover their real bearing upon the public health. Among these are such matters as the effect of a smoky atmosphere, the alleged nervous strain due to city noise and numerous important questions in the domain of food adulteration and contamination. Premature and drastic action by health authorities in matters concerning which there is profound disagreement among experts may cast discredit on other lines of activity in which there is and can be no difference of opinion.

For the present it seems worth while to emphasize more sharply than heretofore the distinction between public health measures of proved value and those that owe their existence to tradition or to misdirected and uninformed enthusiasm. Further study of the results obtained by certain of the usual and conventional health department activities is also much needed, and as a preliminary to such study the proper collection and handling of vital statistics is essential. It is poor management and unscientific procedure to continue to work blindly in matters pertaining to the public health, to employ measures of whose real efficiency we are ignorant and even to refrain from collecting facts that might throw light upon their efficiency.

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THE ENGINEERING SCHOOL GRADUATE: HIS STRENGTH AND HIS WEAKNESS[1]

So much has been written and spoken of late concerning the success or failure of the various engineering courses in our schools of technology that a reason should be offered for the introduction of this topic at this time. It is to be found, I think, in the general and increasing interest in these matters which is leading the practising engineers, the manufacturers, the men of affairs, in short, the consumers of the product of the engineering schools, to examine and evaluate the work of these schools. This interest has voiced itself more and more freely in the daily press, the engineering journals, and the occasional address. Some of the comments thus made are harshly critical, some are based upon sadly insufficient knowledge of existing conditions, but many are sane and helpful. It is the duty of those of us who are charged with the conduct of those courses to give heed to these utterances and to avail ourselves of the helpful counsel which many afford; but it is also a privilege which we may sometimes allow ourselves to present the case as it appears to us, and this anniversary occasion seems to suggest both retrospection and introspection.

The complexity of the educational problem is nowhere greater to-day than in the training of the engineer, using that term in a broad sense to include the man who applies his science to concrete ends, whether he be, for example, civil engineer, research chemist, or field geologist. The boundaries of all the sciences have been extended at a rate which has far outstripped any reasonable alteration of educational methods to meet these changing conditions; for, over against the charge of undue conservatism which is commonly made with respect to educational practises, should be placed the fact that seven years is the minimum period which must elapse before the ultimate success or failure of an educational experiment can be determined, and since the remodeling of a course or system of

[1] Presented before the Congress of Technology at the fiftieth anniversary of the granting of the charter of the Massachusetts Institute of Technology.